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A CLARIFICATION OF AN IMPLICATION OF THE EFFICIENT MARKET THEORY

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Summary:

We hope to clarify an implication of the efficient market theory that may have been overstated. Specifically, even in the presence of market efficiency in the semi-strong form, the form of disclosure may have substantive bearing on the choice between two information systems that provide the same amount of information.

Introduction

In a series of three papers [Beaver (1972, 1973, 1974)], William H. Beaver has provided the accounting profession with an important introduction to the efficient market literature. He has succeeded in bringing about a general willingness within the profession to accept the efficient market theory in the semi-strong form and to consider seriously the implications of that acceptance on the formulation of accounting principles [e.g., FASB (1976), pp. 38-42]. Unfortunately these implications may have been overstated. Beaver and others suggest that in the presence of markets efficient in the semi-strong form, principle setting should concern itself only with what should be disclosed and whether those disclosures can be effected most economically through the accounting information set. The current paper will review some of the literature evidencing these implications, and then will illustrate that it is possible that a given accounting system can be improved upon such that it Pareto dominates the original system, even though it continues to <u>disclose the same information</u>. That is, Pareto dominance can be achieved solely through a change in the <u>form</u> of disclosure.

Bierman (1974, p. 557), in contending that implications of the efficient markets theory are overstated, specifically contends:

> (a) It has not been shown that the efficient market hypothesis reduces the importance of improving conventional financial accounting.

Bierman does not distinguish whether he is referring to "improving conventional financial accounting" by changing the <u>amount</u> of information disclosed or the <u>form</u> in which it is disclosed. Beaver (1974, p. 566) responds only to the possibility of changing the amount of information disclosed. He refers the reader to another of his papers [Beaver (1973),

pp. 54-56], but the most relevant section on those pages, i.e., that one ending with: "Disclosure is a substantive issue." (p. 55), only responds directly to Bierman's contention relative to the amount of information.

In a paper which had considerable exposure among practicing accountants, Beaver (1973) makes statements that might indicate that the form of disclosure should not be considered by the FASB:

> First: Many reporting issues are trivial and do not warrant an expenditure of FASB resources. The properties of such issues are twofold: (1) There is essentially no difference in cost to the firm of reporting either method. (2) There is essentially no cost to statement users in adjusting from one method to the other. In such cases, there is a simple solution. Report one method, with sufficient footnote disclosure to permit adjustment to the other, and let the market interpret implications of the data for security prices. (p. 52)
>
> The naive investor can still get harmed, but not in the ways traditionally thought. For example, the potential harm is not likely to occur because firms use flow-through v. deferral for accounting for investment credit. (p. 53)

In the conclusion:

> 1. Many reporting issues are capable of a simple disclosure solution and do not warrant an expenditure of FASB time in attempting to resolve them.
>
> ⋮
>
> 3. Financial statements should not be reduced to the level of understanding of the naive investor. (p. 56)

One can infer that Beaver is not concerned with whether individuals may be unable to properly interpret financial statements (except that they may be caused to incur excessive commission costs attempting to earn abnormal returns).

Beaver's paper appears to have had an impact on the profession, at least to the extent of the FASB's Tentative Conclusions on Objectives Financial Statements of Business Enterprises (1976) which adopts similar implications of the presence of an efficient market:

> Among the implications accompanying acceptance of the efficient market hypothesis are: that accountants' and managements' often expressed concern about confusing investors by giving them too much information is probably not a valid concern; and that the accounting profession has probably spent too much time effort and money attempting to resolve problems that could as readily have been handled simply by additional disclosure. (p. 42)

The purpose of the present paper is not to state that the amount of disclosure is not an important issue, but rather to point up that form of disclosure remains an important issue even under the assumption that markets are efficient in the semi-strong form.

An Interpretation of an Informationally Efficient Form of Disclosure

In his survey of the empirical literature, Fama (1970) suggested that a market is efficient with respect to some set of information if that set of information is "fully reflected" in prices. Although the expression "fully reflect" has become synonymous with empirical tests demonstrating that excess returns cannot be earned, it is ambiguous. One way of conveying the idea of "fully reflect" more precisely is to say that a market is informationally efficient with respect to some set of information $\hat{A}$, say, where $\hat{A}$ may be all publicly available information, if the prices it generates are identical to those generated in an otherwise identical market in which each and every investor's expectations are correctly specified on the basis of $\hat{A}$. This is pointed out by Rubinstein

(1975) in greater detail. A more informal way of expressing this is to say that a market is informationally efficient if market expectations, as represented by prices, aggregate the diverse opinions of investors in such a fashion that the prices which result are those that would have resulted had each investor's expectations been correctly specified on the basis of $\hat{A}$. (Later in the paper a specific example will be given which illustrates this.)

The motivation behind this interpretation comes from the suggestion in the empirical literature that excess returns cannot be earned. If a market is informationally efficient with respect to all publicly available information, then the theory implies that anyone whose expectations are correctly specified on the basis of all publicly available information would not be expected to earn an excess return because the prices he encounters in the market are identical to those he would encounter in an otherwise identical market in which everyone's expectations are correctly specified on the basis of all publicly available information. Consequently he sees his expectations as "fully reflected" in prices despite the fact that no one else may actually have an assessment as accurate as his.

To re-cast this interpretation in an accounting context, we will represent a form of disclosure by η. η will be said to be informationally efficient with respect to all publicly available information if the prices that result when η is used to disclose the activities of firms are identical to those that arise in an otherwise identical market in which each investor's expectations are correctly specified on the basis of all publicly available information. Let H represent the set of all

the various forms of disclosure that are informationally efficient with respect to all publicly available information.

Clearly since all members of H disclose information in such a fashion that a market is efficient with respect to all publicly available information, we should be indifferent as to which member of H is used if our sole concern were market information efficiency. However, it may be that some members of H strictly Pareto dominate other members. That is, we have the following proposition.

Proposition. All investors may strictly prefer one form of disclosure to another despite the fact that both effect market information efficiency.

An Example to Validate the Proposition

Let us consider a one-period market that offers two securities, one of which is risk-free in that it has a fixed yield, and the other of which is risky in that its return is uncertain. Let S_F represent the risk-free security; it will be assumed that there is an unlimited supply of S_F available, each share of which sells for one dollar (i.e., the price of S_F is a numeraire). S_R will represent the risky security; each share of S_R sells for P dollars. We will assume that there are 693,000 shares of S_R available. In addition shares of both S_F and S_R are assumed to be infinitely divisible.

Each full share of S_F purchased at the beginning of the period yields an end-of-period return of 1.03 dollars, whereas a full share of S_R yields a random end-of-year return $\tilde{R}$ which is equal to either 1.08 or 0.98 dollars. Which of the two possible returns $\tilde{R}$ assumes will

depend upon the end-of-year performance of the risky investment. Let us imagine, however, that the true underlying distribution of returns of $\tilde{R}$ on the basis of all publicly available information should be $\tilde{R} = 1.08$ with probability 2/3, and $\tilde{R} = 0.98$ with probability 1/3.

Suppose that 100,000 investors participate in the market at the beginning of the year to adjust their holdings of risk-free and risky securities. We will represent each investor by I^i, $i = 1, \ldots, (100{,}000)$, and allow each to be endowed with $\bar{S}_F^i$ and $\bar{S}_R^i$ units of risk-free and risky securities, respectively. Then the wealth I^i has available for investing at the beginning of the period is

$$W^i = \bar{S}_F^i + P\cdot\bar{S}_R^i \tag{1}$$

Let us suppose that each investor will express his preference for wealth x <u>as if</u> it could be represented by the utility function $U^i(x) = -\exp[-x]$. Then, assuming each investor is Savage rational, his expected utility for holding S_F^i units of the risk-free and S_R^i units of the risky security, respectively, would be:

$$E[U^i(S_F^i, S_R^i)]$$

$$= -\exp[-1.03\cdot S_F^i]\ \{\exp[-1.08\cdot S_R^i]\cdot P^i[\tilde{R} = 1.08] + \exp[-0.98\cdot S_R^i]\cdot P^i[\tilde{R} = 0.98]\}, \tag{2}$$

where $P^i[\tilde{R} = 1.08]$, $P^i[\tilde{R} = 0.98]$ represents I^i's expectation, or belief, that $\tilde{R} = 1.08$, $\tilde{R} = 0.98$, respectively, at the end of the period.

We will now consider two hypothetical situations that are distinguishable solely by the form of disclosure that is employed. Let η represent the form used in the first situation. η reports on the activities

of the risky investment up until and including the beginning of the period. Let us imagine that η provides such a thoroughly clear and understandable presentation of information about the risky investment that each investor has the correct assessment of $\tilde{R}$ on the basis of all publicly available information. Specifically, for i = 1, ..., (100,000),

$$P^i[\tilde{R} = 1.08|\eta] = 2/3$$

$$P^i[\tilde{R} = 0.98|\eta] = 1/3$$

When η is employed, each investor's holdings of risk-free and risky securities after trading, S_F^i, S_R^i, respectively, as well as P itself, can be computed:

$$S_F^i|\eta = W^i - 6.93$$

$$S_R^i|\eta = 6.93$$

$$P|\eta = 0.67$$

Note that differences in endowed wealth result in different levels of S_F^i. (Refer to Appendix for the derivation of $S_F^i|\eta$, $S_R^i|\eta$, $P|\eta$).

Suppose that an alternative form of disclosure, η', can be employed to report on the activities of the investment. It will be assumed that η' is significantly less clear and understandable than η and consequently results in expectations that are misspecified. For example suppose that on the basis of η' exactly one-half of the investors are overly optimistic about the performance of the risky investment and expect

$$P^i[\tilde{R} = 1.08|\eta'] = 4/5$$

$$P^i[\tilde{R} = 0.98|\eta'] = 1/5 \quad .$$

$i = 1, \ldots, (50{,}000)$. The second half of the investors are simply confused when η' is used and consequently regard $\tilde{R} = 1.08$, $\tilde{R} = 0.98$ as equally likely events:

$$P^i[\tilde{R} = 1.08|\eta'] = 1/2$$
$$P^i[\tilde{R} = 0.98|\eta'] = 1/2 \quad ,$$

$i = (50{,}001), \ldots, (100{,}000)$. With these expectations, holdings and prices will be as specified below:

for $i = 1, \ldots, (50{,}000)$

$$S^i_F|\eta' = W^i - 13.86$$
$$S^i_R|\eta' = 13.86$$

for $i = (50{,}001), \ldots, (100{,}000)$

$$S^i_F|\eta' = W^i$$
$$S^i_R|\eta' = 0$$

$$P|\eta' = 0.67$$

(Refer to Appendix for derivation).

The salient feature of these two situations is that the prices of risk-free and risky securities are identical to those that would arise if each and every investor's expectations were correctly specified. (Of course, η satisfies this requirement by definition). Thus both achieve market information efficiency with respect to all publicly available information.

Nonetheless, η Pareto dominates η'. To demonstrate this, let us consider each investor's expected utility in the two situations assuming that his expectations had been correctly specified.[1] When η is employed, each I^i holds (after trading) $W^i - 6.93$ shares of S_F, and 6.93 shares of S_R. Thus his expected utility can be derived by substituting these values for S^i_F, S^i_R in equation (1), and letting $P^i[\tilde{R} = 1.08] = 2/3$, $P^i[\tilde{R} = 0.98] = 1/3$:

$$E[U^i(W^i - 6.93,\ 6.93)] = -(.94)\ e^{-1.03W^i}$$

When η' is employed, I^i, $i = 1, \ldots, (50{,}000)$, holds $W^i - 13.86$ shares of S_F and 13.86 shares of S_R after trading. Thus his expected utility for these holdings, assuming that his expectations have been correctly specified would be (use equation (1) with $P^i[\tilde{R} = 1.08] = 2/3$, $P^i[\tilde{R} = 0.98] = 1/3$):

$$E[U^i(W^i - 13.86,\ 13.86)] = -e^{-1.03W^i}$$

For I^i, $i = (50{,}001), \ldots, (100{,}000)$, trading when η' is employed results in purchasing no shares of the risky security. Thus his expected utility would be

$$E[U^i(W^i,\ 0)] = -e^{-1.03W^i}$$

Since the expected utility of each individual regardless of his endowed wealth is greater when η is employed than when η' is employed, η strictly Pareto dominates η'.

Summary

The intuition that motivates this example is very simple. Whichever reporting alternative is chosen, prices remain the same. Thus each investor's endowed wealth is unaffected by the choice of reporting mechanism. But when η is employed, investors have a better, or more correct, assessment of the uncertainty and consequently allocate their holdings correctly. On the other hand when η' is used, expectations are less well specified, which results in a less appropriate allocation of shares and, in turn, a lower expected utility. The point is that market information efficiency assures a correct assessment of the aggregate expectation, prices. But the accuracy of individual expectations will dictate whether a form of disclosure will be preferred

at an individual level. Therefore we should be concerned with a choice among forms of disclosure despite the substantial empirical evidence that the market is efficient with respect to all publicly available information.

Although the discussion stops short of suggesting how a form of disclosure might be selected to improve upon the status quo, we can make some broad inferences. First of all, homogeneous expectations do not currently prevail in the market. However, as is demonstrated in the previous example, if two forms of disclosure achieve information efficiency (with respect to all publicly available information) such that the first implies homogeneous beliefs while the second implies heterogeneous, then the former will Pareto dominate the latter. In other words if a form of disclosure exists which achieves information efficiency and at the same time induces greater homogeneity among market participants then under the form of disclosure implied by the status quo, then it will Pareto dominate the status quo. Thus it is reasonable to conclude that a form of disclosure which brings about the greatest homogeneity in expectations (while maintaining market information efficiency) will very likely be the best form of disclosure.

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FOOTNOTES

[1]Considering an investor's expected utility for the two forms of disclosure assuming that his expectations had been correctly specified answers the question: Which of the two forms of disclosure would an investor have preferred *ex ante* if the correct expectation were to be revealed to him after trading? Jaffee-Rubinstein (1977), Ng (1975), and Verrecchia (1978) each argue (in greater detail) that this is the correct way to assess which hypothetical situation will be preferred, since it requires that each situation be evaluated on the basis of the same expectation, i.e., the correct one. In particular, this avoids a type of "apples versus oranges" problem: for example, preferring one form of disclosure to another simply because the first induces wildly optimistic (but grossly incorrect) expectations while the other implies a more sober and more accurate assessment of uncertainty.

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APPENDIX

When trading commences in the market each investor adjusts his holdings of risk-free and risky securities so as to maximize his expected utility subject to his budget constraint. That is, he maximizes equation (2) subject to (1). For convenience let f_1^i and f_2^i represent $P^i[\tilde{R}=1.08]$ and $P^i[\tilde{R}=0.98]$, respectively, and R_1 and R_2 represent 1.08 and 0.98, respectively,

1. A Derivation of S_R^i and S_F^i.

The Lagrange multiplier implied by (1) and (2) is

$$L(S_F^i, S_R^i, \lambda^i) = EU^i(S_F^i, S_R^i) - \lambda^i(S_F^i + PS_R^i - W^i)$$

Differentiating L with respect to S_R^i yields

$$\frac{\partial L}{\partial S_R^i} = R_1 e^{-(FS_F^i + R_1 S_R^i)} f_1^i + R_2 e^{-(FS_F^i + R_2 S_R^i)} f_2^i - \lambda^i P \, . \tag{1A}$$

Differentiating L with respect to S_F^i yields

$$\frac{\partial L}{\partial S_F^i} = F\, e^{-(FS_F^i + R_1 S_R^i)} f_1^i + F\, e^{-(FS_F^i + R_2 S_R^i)} f_2^i - \lambda^i \tag{2A}$$

To obtain a S_R^i, S_F^i that maximizes L set $\frac{\partial L}{\partial S_R^i} = 0$ and $\frac{\partial L}{\partial S_F^i} = 0$:

$$R_1 e^{-(FS_F^i + R_1 S_R^i)} f_1^i + R_2 e^{-(FS_F^i + R_2 S_R^i)} f_2^i = \lambda^i P, \tag{3A}$$

$$F\, e^{-(FS_F^i + R_1 S_R^i)} f_1^i + F\, e^{-(FS_F^i + R_2 S_R^i)} f_2^i = \lambda^i \tag{4A}$$

Then divide (4A) into (3A): this implies

$$\frac{R_1 e^{-R_1 S_R^i} f_1^i + R_2 e^{-R_2 S_R^i} f_2^i}{F\, e^{-R_1 S_R^i} f_1^i + F\, e^{-R_2 S_R^i} f_2^i} = P \tag{5A}$$

Simplifying (5A),

$$R_1 e^{-(R_1 - R_2) S_R^i} f_1^i + R_2 f_2^i = FP[e^{-(R_1 - R_2) S_R^i} f_1^i + f_2^i],$$

or

$$e^{-(R_1 - R_2) S_R^i} f_1^i [R_1 - FP] = f_2^i [FP - R_2].$$

Finally, this implies

$$S_R^i = \frac{1}{(R_1 - R_2)} \ln \left(\frac{R_1 - FP}{FP - R_2} \cdot \frac{f_1^i}{f_2^i} \right). \tag{6A}$$

Consequently

$$S_F^i = W^i - S_R^i \tag{7A}$$

2. <u>A Derivation of P.</u>

To derive the price of a risky security, P, sum (6A) over i:

$$S_R^T = \sum_{i=1}^{100,000} S_R^i = \sum_{i=1}^{100,000} \frac{1}{(R_1 - R_2)} \ln \left(\frac{R_1 - FP}{FP - R_2} \cdot \frac{f_1^i}{f_2^i} \right)$$

$$= \frac{1}{(R_1 - R_2)} \left\{ (100,000) \ln \left(\frac{R_1 - FP}{FP - R_2} \right) + \ln \left(\prod_{i=1}^{100,000} \frac{f_1^i}{f_2^i} \right) \right\}.$$

Rearranging we have

$$\ln\left[\frac{R_1-FP}{FP-R_2}\right] = \frac{1}{(100,000)}\ \ln\left[\prod_{i=1}^{100,000}\frac{f_2^i}{f_1^i}\right] + \frac{(R_1-R_2)}{100,000}\ S_R^T$$

Then take the exponential factor of each side to obtain

$$\frac{R_1-FP}{FP-R_2} = \left[\prod_{i=1}^{100,000}\frac{f_2^i}{f_1^i}\right]^{\frac{1}{100,000}} \exp\left[\frac{R_1-R_2}{100,000}\ S_R^T\right] .$$

Solving for P yields

$$P = \frac{1}{F}\ \{(\frac{1}{1+Q})\ R_1 + (\frac{Q}{1+Q})\ R_2\}\ , \tag{8A}$$

where

$$Q = \left[\prod_{i=1}^{100,000}\frac{f_2^i}{f_1^i}\right]^{\frac{1}{100,000}} \exp\left[\frac{R_1-R_2}{100,000}\ S_R^T\right] . \tag{9A}$$

By substituting the values

$$S_R^T = 693,000$$

$$R_1 = 1.08 \qquad F = 1.03 \qquad R_2 = 0.98$$

and when η is employed

$$f_1^i = 2/3 \qquad f_2^i = 1/3 \qquad i=1,\ldots,(100,000),$$

and when η' is employed

$$f_1^i = 4/5 \qquad f_2^i = 1/5 \qquad i=1,\ldots,(50,000)$$

$$f_1^i = 1/2 \qquad f_2^i = 1/2 \qquad i=(50,001),\ldots,(100,000),$$

we can derive P, S_R^i, S_F^i by means of equations (6A), (7A), (8A), and (9A).